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ATTORNEY DOCKET NO. 502972-PCT-US-B

CLIENT REF. NO. 03-2285B-US

U.S. APPLICATION NO. 60/516,148

**TRANSMITTAL LETTER TO THE UNITED STATES  
 DESIGNATED/ELECTED OFFICE (DO/EO/US)  
 CONCERNING A FILING UNDER 35 USC 371 AND 37 CFR 1.491**

INTERNATIONAL APPLICATION NO.  
 PCT/US2004/35651

INTERNATIONAL FILING DATE  
 October 27, 2004

PRIORITY DATE CLAIMED  
 October 31, 2003

TITLE OF INVENTION METHOD AND APPARATUS FOR CONTROLLING EXHAUST GAS RECIRCULATION AND START OF COMBUSTION IN  
 RECIPROCATING COMPRESSION IGNITION ENGINES WITH AN IGNITION SYSTEM WITH IONIZATION MEASUREMENT

APPLICANT(S) FOR DO/EO/US Ed VanDyne and Mark R. Woolston

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 USC 371 and 37 CFR 1.491.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 USC 371 and 37 CFR 1.491.
3. ☐ This is an express request to begin national examination procedures (35 USC 371(f)).
4. ☐ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 USC 371(c)(2))
  - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ has been communicated by the International Bureau.
  - c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 USC 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 USC 371(c)(3))
  - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ have been communicated by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 USC 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 USC 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 USC 371(c)(5)).
11. Nucleotide and/or Amino Acid Sequence Submission
  - a. ☐ Computer Readable Form (CRF)
  - b. Specification Sequence Listing on:
    - i. ☐ CD-ROM or CD-R (2 copies); or
    - ii. ☐ Paper Copy
  - c. ☐ Statement verifying identity of above copies

**Items 12 to 19 below concern other document(s) or information included:**

12. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
  - ☐ Form PTO-1449
  - ☐ Copies of References (except for U.S. patents and applications)
13. ☐ An assignment for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
14. ☒ A **FIRST** preliminary amendment.
  - ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☒ Application Data Sheet Under 37 CFR 1.76
18. ☒ Return Receipt Postcard
19. ☐ Other items or information:

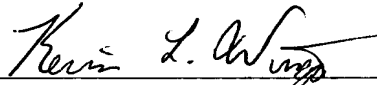
U.S. APPLICATION NO. 60/516,148		INTERNATIONAL APPLICATION NO. PCT/US2004/35651		ATTORNEY DOCKET NO. 502972-PCT-US-B		CLIENT REF. NO. 03-2285B-US	
20. The following fees are submitted:						CALCULATIONS	PTO USE ONLY
<input checked="" type="checkbox"/> <b>National Stage Filing Fee</b>						\$300.00	
<b>Search Fee</b>						\$100.00	
<input checked="" type="checkbox"/> USPTO was ISA						\$100.00	
<input type="checkbox"/> Search report provided to USPTO by other entity						\$400.00	
<input type="checkbox"/> All other situations						\$500.00	
<b>Examination Fee</b>						\$100.00	
<input checked="" type="checkbox"/> US was IPEA and all claims satisfy PCT Article 33(1)-(4)						\$100.00	
<input type="checkbox"/> All other situations						\$200.00	
<b>ENTER APPROPRIATE BASIC FEE AMOUNT=</b>						\$500.00	
<input type="checkbox"/> <b>Claim Fee</b>							
CLAIMS		NUMBER FILED		NUMBER EXTRA		RATE	
Total Claims		15 -20=		0		x \$ 50.00	
Independent Claims		5 - 3 =		2		x \$200.00	
<input type="checkbox"/> <b>Multiple Dependent Claim(s) (if applicable)</b>						+\$360.00	\$
<input type="checkbox"/> <b>Application Size Fee</b> (\$250 for each additional 50 sheets over 100)						\$	
<input type="checkbox"/> <b>Surcharge</b> of \$130.00 for furnishing the National fee or oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date.						\$	
<b>TOTAL OF ABOVE CALCULATIONS=</b>						\$900.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.						\$ ( )	
<b>SUBTOTAL=</b>						\$900.00	
<input type="checkbox"/> Processing fee of \$130.00 for furnishing English Translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date.						\$	
<b>TOTAL NATIONAL FEE=</b>						\$900.00	
<input type="checkbox"/> Fee for recording the enclosed assignment. The assignment must be accompanied by an appropriate cover sheet. \$40.00 per property.						+	\$
<b>TOTAL FEE=</b>						\$900.00	
						Amount to be:	
						refunded	\$
						charged:	\$

- a. ☐ No fee is believed to be due.
- b. ☒ Please charge Deposit Account No. 50-3505 the total fee indicated above.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-3505. A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO CUSTOMER NO.  
53609:

53609

  
Kevin L. Wingate, Registration No. 38662  
Reinhart Boerner Van Deuren P.C.  
483 North Mulford Road, Suite 7  
Rockford, Illinois 61104  
(815) 484-1900 (telephone)  
(815) 484-1032 (facsimile)  
Date: April 21, 2006

**CERTIFICATION UNDER 37 CFR 1.10**

"Express Mail" Label Number: EV 746146227 US

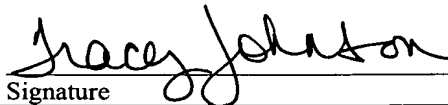
Date of Deposit:

April 21, 2006

I hereby certify that this transmittal document with respect to the U.S. national phase of the above-referenced International Patent Application, including all of the items listed thereon as enclosures, is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Tracey Johnson

Printed Name of Person Signing:

  
Signature

U.S. Patent and Trademark Office  
Randolph Building  
401 Dulany Street  
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ATTORNEY DOCKET NO. 502912 PCT/US-B

**COPY**

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19. ☐ Other items or information:

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CLAIMS		NUMBER FILED		NUMBER EXTRA		RATE	
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<input type="checkbox"/> <b>Surcharge</b> of \$130.00 for furnishing the National fee or oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date.						\$	
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<b>TOTAL FEE=</b>						\$900.00	
						Amount to be: refunded	\$
						charged:	\$
<p>a. <input type="checkbox"/> No fee is believed to be due.</p> <p>b. <input checked="" type="checkbox"/> Please charge Deposit Account No. 50-3505 the total fee indicated above.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-3505. A duplicate copy of this sheet is enclosed.</p> <p><b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b></p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%;"> <p>SEND ALL CORRESPONDENCE TO CUSTOMER NO. 53609:</p> <p style="text-align: center; margin-top: 20px;">53609</p> </div> <div style="width: 45%; text-align: right;"> <p>Kevin L. Wingate, Registration No. 38662 Reinhart Boerner Van Deuren P.C. 483 North Mulford Road, Suite 7 Rockford, Illinois 61104 (815) 484-1900 (telephone) (815) 484-1032 (facsimile) Date: April 21, 2006</p> </div> </div>							

**CERTIFICATION UNDER 37 CFR 1.10**

"Express Mail" Label Number: EV 746146227 US


Date of Deposit:

April 21, 2006

I hereby certify that this transmittal document with respect to the U.S. national phase of the above-referenced International Patent Application, including all of the items listed thereon as enclosures, is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 on the date indicated above and is addressed to Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Tracey Johnson

Printed Name of Person Signing:

  
Signature

## **Application Data Sheet**

### **APPLICATION INFORMATION**

Application Type:: Regular  
Subject Matter:: Utility  
Suggested classification::  
Suggested Group Art Unit::  
CD-ROM or CD-R?:: None  
Number of CD Disks:  
Number of Copies of CDs::  
Sequence Submission?::  
Computer Readable Form (CRF)?:: No  
Number of Copies of CRF::  
Title:: METHOD AND APPARATUS FOR CONTROLLING  
EXHAUST GAS RECIRCULATION AND START OF  
COMBUSTION IN RECIPROCATING COMPRESSION  
IGNITION ENGINES WITH AN IGNITION SYSTEM WITH  
IONIZATION MEASUREMENT  
Attorney Docket Number:: 502972-PCT-US-B  
Request for Early Publication?:: No  
Request for Non-Publication?:: No  
Suggested Drawing Figure::  
Total Drawing Sheets::  
Small Entity?:: No  
Latin Name::  
Variety denomination name::  
Petition Included?:: No  
Petition Type::  
Licensed US Govt. Agency::  
Contract or Grant Numbers::  
Secrecy Order in Parent Appl.?:: No

## APPLICANT INFORMATION

Applicant Authority Type:: Inventor  
Primary Citizenship Country:: US  
Status:: Full Capacity  
Given Name:: Ed  
Middle Name::  
Family Name:: VanDyne  
Name Suffix::  
City of Residence:: Loveland  
State or Prov. of Residence:: CO  
Country of Residence:: US  
Street of mailing address:: 2604 Farisita Drive

City of mailing address:: Loveland  
State or Province of mailing address:: CO  
Country of mailing address:: US  
Postal or Zip Code of mailing address:: 80538  
Inventor Authority Type:: Inventor  
Primary Citizenship Country:: US  
Status:: Full Capacity  
Given Name:: Mark  
Middle Name:: R.  
Family Name:: Woolston  
Name Suffix::  
City of Residence:: Bolton  
State or Prov. of Residence:: MA  
Country of Residence:: US  
Street of mailing address:: 651 Main Street

City of mailing address:: Bolton  
State or Province of mailing address:: MA  
Country of mailing address:: US  
Postal or Zip Code of mailing address:: 01740



## **CORRESPONDENCE INFORMATION**

Correspondence Customer Number:: 53609  
Phone:: (815) 484-1900  
Fax:: (815) 484-1032  
E-mail Address:: rockmail@reinhardtllaw.com

## **REPRESENTATIVE INFORMATION**

Representative Customer Number:: 53609

## **DOMESTIC PRIORITY INFORMATION**

Application::	Continuity Type::	Parent Application::	Parent Filing Date::
This Application	National Stage of	PCT/US2004/35651	October 27, 2004
This Application	An application	60/516,148	October 31, 2003
	claiming the benefit		
	under 35 U.S.C.		
	119(e)		

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of:

Ed VanDyne, et al.

Application No.: Not Yet Assigned

Art Unit: Not Yet Assigned

Examiner: Not Yet Assigned

Filed: April 21, 2006

For: METHOD AND APPARATUS FOR CONTROLLING  
EXHAUST GAS RECIRCULATION AND START OF  
COMBUSTION IN RECIPROCATING COMPRESSION  
IGNITION ENGINES WITH AN IGNITION SYSTEM WITH  
IONIZATION MEASUREMENT

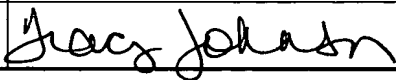
**PRELIMINARY AMENDMENT**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Prior to the examination of the above-identified application, please consider the following remarks.

Amendments to the claims are reflected in the claim listing which begins on page 2.  
Remarks begin on page 6.

<b><i>CERTIFICATE OF MAILING OR TRANSMISSION UNDER 37 CFR 1.8</i></b>			
I hereby certify that this Preliminary Amendment and all accompanying documents are, on the date indicated below, <input checked="" type="checkbox"/> being deposited with the United States Postal Service as "Express Mail Post Office to Addressee" Service under 37 CFR 1.10 to: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.			
Name (Print/Type)	Tracey Johnson		
Signature		Date	April 21, 2006

*CLAIM LISTING*

1-53. (Cancelled)

54. (Original) A method for controlling the maximum power of a reciprocating engine having at least one combustion chamber comprising the steps of:  
determining a target ion current corresponding to a desired burn rate;  
comparing an average ion current signal to the target ion current; and  
adjusting the amount of fuel admitted into the at least one combustion chamber until the average ion current signal is within a tolerance window of the target ion current.

55. (Original) The method of claim 54 further comprising the step of adjusting a timing of the injection of fuel admitted into the at least one combustion chamber.

56. (Original) The method of claim 54 further comprising the step of adjusting a rate of the injection of fuel admitted into the at least one combustion chamber.

57 (Original) The method of claim 54 further comprising the step of measuring the ionization current with a negative polarity of ionization on the electrode of an ion sensor.

58-73. (Cancelled)

74. (Original) A method of controlling the burn rate in a diesel engine having a combustion chamber using a target angle of the second peak of an ion current waveform corresponding to a desired burn rate, the method comprising the steps of:  
comparing a real time average of the crank shaft angle of the second peak of the ion current wave form to the target angle; and  
adjusting the rate of fuel admitted into the combustion chamber such that the real time average of the angle of the second peak of the ion current waveform is within a tolerance window of the target angle.

75. (Original) The method of claim 74 wherein the step of adjusting the rate of fuel admitted into the combustion chamber comprises the steps of:

if the real time average of the crank shaft angle of the second peak of the ion current wave form is advanced of the target angle, decreasing the rate of fuel admitted into the combustion chamber until the real time average of the crank shaft angle of the second peak of the ion current wave form is within a tolerance of the target angle; and

if the real time average of the crank shaft angle of the second peak of the ion current wave form is retarded of the target angle, increasing the rate of fuel admitted into the combustion chamber until the real time average of the crank shaft angle of the second peak of the ion current wave form is within a tolerance of the target angle.

76. (Original) The method of claim 74 wherein the start of injection in a diesel engine is also controlled by the ion current wave form, the method further comprising the steps of:

comparing the measured crank shaft angle of the rise of ion current to the target crank shaft angle corresponding to a desired start of combustion; and

adjusting the injection timing such that the crank shaft angle of the rise of ion current is within a tolerance window of the target crank shaft angle.

77. (Original) The method of claim 76 wherein the step of adjusting the injection timing comprises the steps of:

retarding a start of injection angle to move an early angle of the rise of ion current towards the target crank shaft angle for the next cycle; and

advancing the start of injection angle to move a late angle of the rise of ion current towards the given target crank shaft angle for the next cycle.

78. (Original) A method for controlling the maximum power of a diesel engine having a combustion chamber comprising the steps of:

determining a target ion current waveform corresponding to a maximum burn rate;

comparing a real time average ion current waveform to the target ion current waveform; and

increasing at least one of a rate of fuel admitted into the combustion chamber and an amount of fuel admitted into the combustion chamber until the average ion current waveform is within a tolerance window of the target ion current waveform.

79. (Original) A method of controlling the maximum power of a diesel engine by maximizing the second peak of the ion current waveform at a target angle corresponding to a desired burn rate, the method comprising the steps of:

comparing a real time average of an amplitude and crank shaft angle of the second peak of the ion current waveform to the target angle; and

adjusting one of a rate of fuel admitted into the combustion chamber and an amount of fuel admitted into the combustion chamber such that the real time average of the angle of the second peak of the ion current waveform is maximized within a tolerance window of the target angle.

80. (Original) The method of claim 79 wherein the steps of controlling the maximum power to the ideal level such that the second peak of the average real time ion current signal is maximized at the target angle, comprising the steps of:

if the real time average of the crank shaft angle of the second peak of the ion current wave form is advanced of the target angle, decreasing the one of the rate of fuel admitted into the combustion chamber and the amount of fuel admitted into the combustion chamber until the real time average of the crank shaft angle of the second peak of the ion current wave form is within a tolerance of the target angle; and

if the real time average of the crank shaft angle of the second peak of the ion current wave form is retarded of the target angle, increasing one of the rate of fuel admitted into the combustion chamber and the amount of fuel admitted into the combustion chamber until the real time average of the crank shaft angle of the second peak of the ion current wave form is within a tolerance of the target angle.

81. (Original) The method of claim 79 wherein the start of injection in a diesel engine is also controlled using the ion current waveform, the method further comprising the steps of:

comparing the measured crank shaft angle of the rise of ion current to a target crank shaft angle of the rise of ion current corresponding to a desired start of combustion; and

adjusting the injection timing such that the crank shaft angle of the rise of ion current is within a tolerance window of the target crank shaft angle.

82. (Original) The method of claim 81 wherein the step of adjusting the injection timing comprises the steps of:

retarding a start of injection angle to move an early angle of the rise of ion current towards the target crank shaft angle for the next cycle; and

advancing the start of injection angle to move a late angle of the rise of ion current towards the target crank shaft angle for the next cycle.

83. (Original) A method for controlling the maximum power of a directly injected reciprocating engine comprising the steps of:

determining target average ion current features corresponding to the fastest allowable burn rate;

comparing a real time average ion current signal features to the target average ion current features; and

adjusting one of the rate of fuel admitted into the combustion chamber and the amount of fuel admitted into the combustion chamber such that the real time average ion current signal features are within a tolerance window of the target average ion current features.

84. (Original) The method of claim 83 wherein the step of adjusting the one of the rate of fuel admitted into the combustion chamber and the amount of fuel admitted into the combustion chamber includes the step of adjusting the timing of fuel admitted into the combustion chamber.

85-87. (Cancelled)

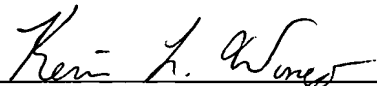
In re Appln. Of: Ed VanDyne et al.  
Application No.: Not Yet Assigned

*REMARKS*

The applicants kindly request that the claim amendments indicated in the Claim Listing be entered prior to examination of the application. No claims have been amended. Claims 1-53, 58-73, and 85-87 have been cancelled. No new claims have been added. Upon entry of the preliminary amendment, claims 54-57 and 74-84 remain pending in the application.

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,



---

Kevin L. Wingate, Reg. No. 38662  
Reinhart Boerner Van Deuren P.C.  
483 North Mulford Road, Suite 7  
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